

REMARKS

Applicants have carefully read and considered the Official Action dated August 2, 2006 and the references cited therein.

Claims 1 and 36 have been amended to clarify that the process of the invention is carried out as part of the operation of a gas processing plant having a train of gas processing operations, and to specify that the uses of the treated gas stream as fuel or purge gas are within the gas processing plant.

Support for the language of the amended claims is found in applicants' specification at paragraphs 56-58, which disclose the use of a train of operations in a gas processing plant, and list representative unit operations; paragraph 103, which discusses uses of purge gas in the plant; and paragraph 32, which discusses uses of fuel gas in the plant.

New claims 57-62 have been added to provide additional protection for applicants' invention. Claim 57, dependent on claim 1, recites a list of unit operations in the gas processing train, and is supported by the teaching of applicants' specification in paragraphs 9, 57 and 58. Claim 58 is a new independent claim drawn to a method of operating a gas processing plant. Support for this claim is found in Figure 1, which shows as element 102 the processing train of a gas processing plant, and the description of this figure from paragraph 55 to paragraph 94. Claims 59 and 60 are new claims, dependent on claim 58, that recite a list of operations in the gas processing train, supported by paragraphs 9, 57 and 58. Claims 61 is dependent on claim 13 and claim 62 is dependent on claim 45, and more narrowly define the polymer list from which materials may be selected. Support for these new limitations is found in the material incorporated by reference from U.S. Patents 6,361,582 and 6,361,583 (col.14, lines 34-39 of '582 and col.13, lines 4-9 of '583).

The examiner has made final a restriction requirement and has withdrawn claims 7, 8, 14-16, 18, 23, 25-35 and 46-56 from consideration.

Claim rejections under 35 USC 102

Claim 1-6, 9-12, 20-22, 24 and 36-44 stand rejected under 35 U.S.C. 102(b) as being anticipated by Robb, U.S. Patent 3,256,675, herein after referred to as Robb.

The examiner states that Robb meets each limitation of applicants' claim 1, including the inlet stream being a reject stream from a gas processing plant, since any system or device capable of performing at least a handling, compressing, transporting or any other manipulative action upon a gas stream would meet the broad recitation of a gas processing plant, and thus any means that would provide the subject gas stream to the inlet of the membrane separation system would meet the requirement of the preamble of claim 1.

The examiner further states that, with respect to the step of burning the residue stream as fuel, it is inherent that a natural gas stream will be burned at some point downstream.

Arguments in support of claim 1 and its dependent claims

Applicants believe that their specification explicitly describes what is meant by a gas processing plant in the normal parlance of the natural gas industry and in the context of the invention. Referring to Figure 1 and paragraphs 54-57 of applicants' specification, a gas processing plant has a train of gas separation operations, such as cryogenic distillation, absorption, adsorption, and molecular sieving. Nevertheless, they thank the examiner for pointing out that the claim language is not explicitly so limited, and they have amended claim 1 to include the operation of gas separation steps within the gas processing plant in the body of the claim, and to make clear that the feed stream to the membrane unit is a waste stream from the main gas flow along the train of operations.

Robb does not explicitly disclose any such train of operations. Further, the use of such a train of operations is not inherent in Robb, because it is not a necessary result of following Robb's teaching.

With regard to the statement that it is inherent that a natural gas residue stream will be burned at some point downstream, applicants respectfully dispute this. Various other uses for natural gas, such as a chemical feedstock (for example in the widely practiced manufacture of synthesis gas by steam reforming), are commonplace.

Based on the above arguments, applicants submit that claim 1, and, by the same reasoning, its dependent claims 2-6, 9-12, 20-22 and 24, are not anticipated by Robb.

Arguments in support of claim 36 and its dependent claims

Claim 36 is an independent claim, with dependent claims 37-44. The examiner has not given any explanation for rejecting this set of claims, his comments being directed to claim 1 and its dependent claim 22 only.

Claim 36 has been amended in like manner to claim 1. Applicants urge that the arguments made above in support of the patentability of claim 1 and its dependent claims apply in full measure also to the patentability of claims 36-44.

Claim rejections under 35 USC 103(a)

(A) Rejection on basis of Robb alone

Claims 1-6, 9-12, 17, 19-22, 24 and 36-44 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Robb.

The examiner states that it would have been obvious for an artisan at the time of the invention to provide the inlet stream to the membrane separation processes as disclosed by Robb from a typical gas processing plant or to burn the residue, natural gas stream as a fuel.

Applicants respectfully disagree on both counts.

Robb discloses various types of gas separation processes that can be used to recover helium from gas mixtures, specifically adsorption and distillation, at col. 1, lines 31-38. The disadvantages of existing treatments, such as cost and complexity, are explicitly mentioned in lines 34-38. A few lines later, at col.1, lines 43-45, the first object of Robb's invention is stated to be the provision of an improved gas separation or enrichment method and apparatus.

In light of these comments, applicants believe that the teachings of the reference are that membrane separation is an improvement over other methods, and that the processes provided by Robb are intended to replace other disadvantageous types of gas separation treatment, not to require their presence, as is the case with applicants' invention.

In other words, Robb teaches away from the processes that are included in a typical gas processing train of the type defined by applicants. Further, if such processes are absent, as taught by Robb, then applicants' invention does not exist, because there are then no reject gas streams from them to treat.

From another perspective, for Robb to render applicants' invention obvious, there must be some basis in Robb to suggest to the skilled worker what applicants did.

It is respectfully submitted that no such basis exists. There is no mention of reject gas streams in Robb. There is no mention, except in a pejorative manner, of non-membrane natural gas separation processes in Robb. In fact, when discussing the treatment of an exemplary natural gas stream that contains carbon dioxide (col.8, line 7 to col. 9, line 25), Robb suggests using membrane separation steps (carried out in membrane separation units 64 and 68 of the apparatus of Figure 4), not amine scrubbing or other conventional process, to separate carbon dioxide from the raw gas mixture.

In view of the above, and when applicants' claims are read as a whole, it seems to applicants that Robb cannot reasonably be argued to suggest the specific membrane feed streams, sequence of steps, and

relationship of membrane separation as a side operation on a waste gas to the process train in a gas processing plant that is recited in claims 1 and 36 and their dependent claims.

With regard to burning the residue, natural gas stream as a fuel, this is also not considered to be suggested by Robb. Applicants have not claimed the burning of natural gas as a fuel at an unspecified ultimate destination, but have now explicitly limited their claims, including independent claim 36, to processes in which the reject gas stream is used to provide fuel for one or more of the operations within the train of operations in the gas processing plant. Since Robb does not teach or suggest such a process train of operations, and does not suggest any need or use for fuel gas in operating his membrane separation unit, applicants fail to see how Robb could suggest the idea of using waste gas to supply needed heat to a unit operation in a gas-processing train.

Patentability over Robb of newly presented claims

As part of this response, applicants have presented six new claims, claims 57-62, for consideration. Claims 61 and 62 are dependent on claims 13 and 45, which are not subject to this grounds of rejection, so are not discussed here.

Claim 57 is dependent on claim 1, and limits the gas separation train to include at least one of a list of four types of non-membrane gas separation step. For the reasons presented above with respect to claim 1, this claim is believed not to be obvious over the teachings of Robb. In addition, none of the gas separation steps recited in claim 57 is included or suggested in Robb, except in a pejorative mention that discourages their use. Applicants believe therefore, that claim 57 is patentable over Robb.

Claim 58 is an independent claim drawn to a method of operating a gas processing plant by flowing a gas stream through a train of gas separation steps, and withdrawing a waste stream to be treated by membrane separation. Claims 59 and 60 are dependent on claim 58, and limit the gas processing train to include at least one or two specific separation operations. Robb is silent on gas processing trains,

and on non-membrane gas separation treatment. Applicants believe therefore, that claims 58-60 are patentable over Robb.

(B) Rejection on basis of Robb in view of Nemser

Claims 13 and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Robb as applied to claims 1-6, 9-12, 17, 19-22, 24 and 36-44 and further in view of Nemser.

The examiner's position is that Robb substantially discloses applicants' invention as recited by claims 13 and 45, except for the membranes being made from a fluorinated dioxole, fluorinated dioxolane or fluorinated cyclically polymerizable alkyl ether. Nemser discloses the specific use of fluorinated dioxoles as membrane materials to separate helium from nitrogen or methane, so it would have been obvious to substitute the fluorinated dioxole membrane for the membranes of Robb.

The examiner's position is respectfully traversed.

As the examiner points out, Nemser teaches the use of membranes made from a specific fluorinated dioxole, perfluoro-2,2-dimethyl-1,3-dioxole.

In discussing their preference for fluorinated dioxoles, fluorinated dioxolanes or fluorinated cyclically polymerizable alkyl ethers (paragraph 64), applicants clearly state that they are of the type disclosed in U.S. Patents 6,361,582 and 6,361,583, and those patents are incorporated by reference into applicants' specification. The examiner's attention is drawn to the section that appears at col.14, lines 9-17 of 6,361,582 and at col.12, line 48-56 of 6,361,583.

This section reads as follows:

"As a further example that some members of the polymer groups cited above are not suitable for practice of the invention, certain of the dioxole polymers and copolymers of perfluoro-2,2-dimethyl-1,3-dioxole reported in U.S. Pat. No. 5,051,114 have been shown to be susceptible to

plasticization to the point of switching from being selective for nitrogen over hydrocarbons to being selective for hydrocarbons over nitrogen as the hydrocarbon partial pressure increases.”

In the above-quoted paragraph, applicants point out that it is already known in the art that the materials taught in Nemser plasticize in the presence of hydrocarbons and cannot maintain their original properties. In view of this knowledge, applicants believe that the skilled artisan would not have been motivated to substitute the dioxole polymers of Nemser for the polycarbonate of Robb, because the hydrocarbon concentration, and hence partial pressure, in a natural gas stream will generally be high.

With regard to the fluorinated dioxolanes and fluorinated cyclically polymerizable alkyl ethers recited in claims 13 and 45, Nemser is believed to be immaterial, because such materials are not taught therein.

Immediately following the above quoted passage, the incorporated patents go on (col.14, lines 18-39 of ‘582, and col.12, line 56 to col.13, line 9 of ‘583) to read as follows:

“These polymers are, however, characterized by very high fractional free volume within the polymer, typically above 0.3. For example, a paper by A. Yu. Alentiev et al, "High transport parameters and free volume of perfluorodioxole copolymers", Journal of Membrane Science, Vol. 126, pages 123-132 (1997) reports fractional free volumes of 0.32 and 0.37 for two grades of perfluoro-2,2-dimethyl-1,3-dioxole copolymers (Table 1, page 125). Likewise, these polymers are of low density compared with other polymers, such as below about 1.8 g/cm³ and are unusually gas permeable, for instance, exhibiting pure gas permeabilities as high as 1,000 Barrer or more for oxygen and as high as 2,000 Barrer or more for hydrogen. It is believed that polymers with denser chain packing, and thus lower fractional free volume, higher density and lower permeability, are more resistant to plasticization. Hence, the polymers used in the invention to form the selective, discriminating layer of the membrane should preferably be limited, in addition to the specific structural limitations defined and discussed above, to those having a fractional free volume less than about 0.3.”

Applicants have included with this response two new claims, 61 and 62, dependent on claims 13 and 45, but of narrower scope in that the fluorinated dioxoles, fluorinated dioxolanes and fluorinated cyclically polymerizable alkyl ethers have a fractional free volume less than about 0.3. Such materials are not taught by Robb or Nemser; therefore these claims are believed to be patentable over these references.

Applicants have included with this response a check for \$250 to cover filing of six additional claims, of which one is independent, by a small entity.

Reconsideration and reexamination of the application are requested. In view of the above amendments and arguments, allowance of all claims is now believed to be in order, and such action is earnestly solicited at an early date.

Respectfully submitted,



Janet Farrant

Registration no. 32,453

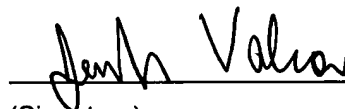
Membrane Technology and Research, Inc.
1360 Willow Road, Suite 103
Menlo Park, CA 94025

Tel: 650-543-3348
Fax: 650-328-6580
email: jfarrant@mtrinc.com

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Assistant Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450

11/21/06

(Date of Deposit)



(Signature)